May, 1984

29TH ANNUAL McGRAW-HILL SURVEY OF BUSINESS' PLANS FOR RESEARCH AND DEVELOPMENT EXPENDITURES, 1984-87

In spite of large gains in both corporate profits and capital spending, research and development (R&D) spending in the U.S. will increase at a slower rate than last year.

R&D outlays are pegged to rise 8.3% in 1984 to $71 billion. That advance is slower than the 11.1% increase recorded last year and well beneath the 16% annual gain reached in 1981.

These are highlights of McGraw-Hill's annual survey of business' R&D plans, conducted in March and April. Survey results are based on responses from more than 300 companies, but figures in this report are adjusted to represent spending by all U.S. firms.

The survey results indicate an unwillingness by business to increase the pace of R&D spending until more progress is made in modernizing and expanding plant and equipment. Currently, a large percentage of corporate funds are being funneled into such projects, suggesting that firms want to fully utilize current technologies before stressing development of new ones.

One reason to be more optimistic about 1984 R&D spending can be found in last year's survey results. A year ago, survey respondents expected to increase 1983 spending 8.2%. However, once the economic

recovery got into full swing, 1983 R&D expenditures ended up rising 11.1%. Thus the possibility again exists that further expansion of corporate profits and cash flow could lead to larger increases in 1984 R&D spending than the survey suggests.

A second reason that the survey results can be looked at in a favorable light is that inflation continues to be lower than it was several years ago. Therefore, once the data is adjusted for smaller price increases, the R&D slowdown is much less severe. In 1984, inflation will probably be in the 4%-5% range. Chart I shows the growth in R&D spending both before and after the inflation adjustment.

CHART I

However, compared to other business spending this year, R&D growth is comparatively weak. According to the latest McGraw-Hill capital spending survey, for example, expenditures on plant and equipment will rise 18.6% in 1984, compared to just 8.3% for R&D. Therefore, for the

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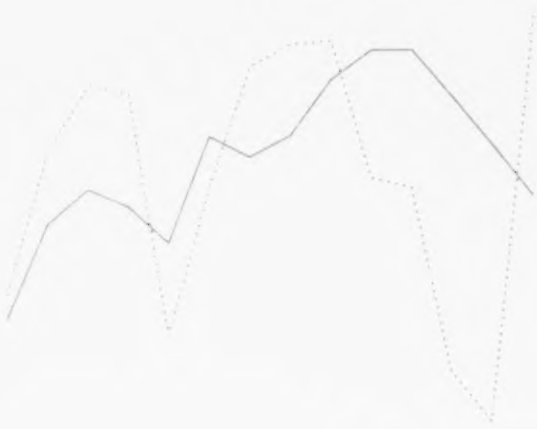
first time in four years, R&D expenditures will fall as a percent of capital spending (Table V). But that is typical in an economic expansion, as shown in Chart II. By the same token, R&D spending usually outpaces fixed investment during recession and early recovery, as also shown in Chart II. For example, in 1983 R&D spending was up 11.1%. At the same time, capital expenditures fell close to 3%.

CHART II



One possible explanation for the relative decline in R&D expenditures is that firms maintained an extremely high level of spending through the recession and are now using large amounts of capital spending to reap the benefits of their R&D. For example, in the autos, trucks, and parts industry, plans for R&D spending are up only 5%. In contrast, the auto industry is hiking capital expenditures by 56.1%. The reason? Automotive capital expenditures are being used to improve and modernize factories in ways discovered by previous years'

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R&D expenditures. Specifically, through increased use of robotics, the auto makers are able to increase plant efficiency and lower production cost.

In addition, the automakers are reaping the benefits of their product R&D. Most of the capital spending going to auto industry expansion is slated to produce three models that represented a large R&D expense: Chrysler's garageable minivans, the Voyager and Caravan, GM's mid-engine sportscar, the Fiero, and Ford's aerodynamic front-wheel drive compact cars, the Tempo and Topaz.

This example holds true in most of the industries in 1984: Firms by and large are using this year to invest in existing technologies.

The auto industry example also shows that financial pressures are not holding back R&D spending. The automakers are enjoying a year that seems guaranteed to bring record sales and earnings. In fact, though many industries are recording excellent financial results, many companies are not using their additional earnings to fund rapid increases in R&D. This year, survey respondents expect R&D to total 3% of sales, down slightly from the 3.1% of sales in 1983. However, 3.1% is still a good performance when compared to previous years (Chart III).

CHART III

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While many industries are planning slower growth in R&D, some industries are bucking the trend and are increasing R&D expenditures at an increasingly rapid rate. These are: rubber and plastics, instruments, fabricated metals, and nonferrous metals. In the case of instrumentation and rubber and plastics, research and development is an integral part of their operations, since new products and new technologies are essential for revenue growth.

Most companies indicated a continuing commitment to R&D spending for the next three years, but also indicated there would be no further acceleration in spending growth. For the longer term, survey respondents said spending growth between 1984 and 1987 would remain about 9% on average. This reduced growth compared to the late 1970's and early 1980's primarily reflects 4%-5% R&D growth planned by the electrical machinery, petroleum, and auto industries. Rather than sharply increasing R&D further in the next few years, these industries may instead have decided to consolidate gains reaped through heavy R&D in recent years.

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NOTE: The other manufacturing category in the tables includes lumber, wood products and furniture, tobacco, printing and publishing, leather, jewelry, toys, and transportation equipment other than autos, trucks and parts and aerospace. The nonmanufacturing category includes mining, construction, electric and gas utilities, commercial enterprises and transportation.

SOURCES: National Science Foundation, McGraw-Hill Economics Department

TABLE I

RESEARCH & DEVELOPMENT EXPENDITURES
(Millions of Dollars)

INDUSTRY	1982 ESTIMATED	1983 ESTIMATED	PLANNED 1984	PLANNED 1987	% CHANGE 1983-84	% CHANGE 1984-87
Iron & Steel	510	452	434	454	-4.1	4.8
Nonferrous Metals	325	307	350	450	13.9	28.7
Electrical Machinery	11,925	14,310	15,240	17,443	6.5	14.5
Non-Electrical Machinery	7,879	8,097	8,845	11,894	9.2	34.5
Autos,Trucks & Parts	4,962	5,782	6,071	7,044	5.0	16.0
Aerospace	14,045	16,385	17,923	24,479	9.4	36.6
Fabricated Metals	570	636	717	910	12.7	26.9
Instruments	4,047	4,526	5,109	7,205	12.9	41.0
Stone,Clay & Glass	460	517	528	709	2.1	34.3
Chemicals	6,588	7,308	8,186	10,364	12.0	26.6
Paper & Pulp	626	532	560	673	5.2	20.1
Rubber & Plastic	888	1,491	1,691	2,349	13.4	38.9
Petroleum	2,248	2,213	2,265	2,573	2.3	13.6
Food & Beverage	752	797	879	1,215	10.3	38.2
Textiles	129	142	149	177	4.7	19.2
Other Manufacturing	838	952	1,004	1,177	5.4	17.2
ALL MANUFACTURING	56,792	64,448	69,949	89,116	8.5	27.4
ALL NONMANUFACTURING	2,168	1,068	1,013	1,150	-5.1	13.5
ALL BUSINESS	58,960	65,516	70,962	90,266	8.3	27.2

TABLE II

NEW PRODUCT SALES - 1987
(As a Percent of Total Sales)

INDUSTRY	1987
Iron & Steel	13.7
Nonferrous Metals	9.9
Electrical Machinery	17.7
Non-Electrical Machinery	41.9
Autos,Trucks & Parts	25.0
Aerospace	27.9
Fabricated Metals	11.3
Instruments	27.4
Stone,Clay & Glass	30.5
Chemicals	8.8
Paper & Pulp	2.5
Rubber & Plastic	21.8
Petroleum	2.0
Food & Beverage	14.2
Textiles	22.5
Other Manufacturing	10.1
ALL MANUFACTURING	18.5
ALL NONMANUFACTURING	1.7
ALL BUSINESS	18.4

TABLE III

PERCENT OF R&D EXPENDITURES GOING FOR NEW PRODUCTS,
NEW PROCESSES, AND IMPROVEMENT OF EXISTING PRODUCTS

	ACTUAL 1983			PLANNED 1984			PLANNED 1985		
INDUSTRY	NEW PRODUCTS	NEW PROCESSES	IMPROVE EXISITING PRODUCTS	NEW PRODUCTS	NEW PROCESSES	IMPROVE EXISITING PRODUCTS	NEW PRODUCTS	NEW PROCESSES	IMPROVE EXISITING PRODUCTS
Iron & Steel	68	13	20	70	13	17	50	17	31
Nonferrous Metals	24	21	55	31	22	47	35	22	43
Electrical Machinery	63	15	22	63	15	22	56	18	26
Non-Electrical Machinery	56	7	37	55	6	39	56	7	38
Autos,Trucks & Parts	20	12	68	53	11	35	51	13	36
Aerospace	33	32	34	36	32	33	35	31	34
Fabricated Metals	47	16	37	47	16	37	47	15	37
Instruments	53	8	39	53	8	39	54	8	38
Stone,Clay & Glass	13	12	74	14	13	73	17	15	68
Chemicals	39	8	54	42	7	51	42	9	49
Paper & Pulp	6	71	22	6	71	22	6	71	22
Rubber & Plastic	41	8	51	40	9	51	41	12	47
Petroleum	19	29	53	15	35	49	5	2	93
Food & Beverage	40	10	49	42	12	47	41	12	47
Textiles	24	16	60	23	16	60	26	15	60
Other Manufacturing	73	15	12	74	12	14	77	13	10
ALL MANUFACTURING	43	19	38	47	18	35	45	18	37
ALL NONMANUFACTURING	21	65	14	20	65	14	21	65	14
ALL BUSINESS	43	20	37	46	21	33	43	20	37

TABLE IV

RESEARCH & DEVELOPMENT
AS A PERCENT OF SALES

INDUSTRY	1983	1984
Iron & Steel	0.97	0.81
Nonferrous Metals	0.53	0.52
Electrical Machinery	9.14	8.97
Non-Electrical Machinery	4.51	4.35
Autos,Trucks & Parts	3.79	2.99
Aerospace	23.31	21.85
Fabricated Metals	0.52	0.52
Instruments	9.05	9.18
Stone,Clay & Glass	1.06	0.98
Chemicals	3.84	3.92
Paper & Pulp	0.62	0.58
Rubber & Plastic	2.87	2.95
Petroleum	1.16	1.14
Food & Beverage	0.28	0.28
Textiles	0.27	0.25
Other Manufacturing	0.28	0.32
ALL MANUFACTURING	3.14	3.04

TABLE V

RESEARCH & DEVELOPMENT
AS A PERCENT OF CAPITAL SPENDING

INDUSTRY	1983	1984
Iron & Steel	15.23	9.68
Nonferrous Metals	12.58	9.24
Electrical Machinery	131.28	99.85
Non-Electrical Machinery	65.56	57.36
Autos,Trucks & Parts	80.64	54.23
Aerospace	332.36	263.81
Fabricated Metals	28.65	24.22
Instruments	180.33	167.35
Stone,Clay & Glass	21.10	15.09
Chemicals	55.03	52.97
Paper & Pulp	8.61	8.40
Rubber & Plastic	78.07	61.45
Petroleum	9.43	7.78
Food & Beverage	12.07	11.73
Textiles	10.21	9.75
Other Manufacturing	8.86	8.13
ALL MANUFACTURING	57.79	49.31
ALL NONMANUFACTURING	2.15	1.85
ALL BUSINESS	21.66	21.25

TABLE VI

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES
(Millions of Dollars)

INDUSTRY	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Primary Metals	$ 62	$ 69	$ 74	$ 90	$108	$131	$152	$177	$177	$171	$183
Iron & Steel	42	44	46	55	64	80	84	102	98	97	106
Nonferrous Metals	20	25	28	35	44	51	68	75	79	74	77
Machinery	330	358	455	543	669	781	930	949	901	914	958
Electrical Machinery & Communications	817	904	983	1,516	1,804	1,969	2,329	2,532	2,483	2,639	2,866
Radio & TV Receiving Equipment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Commun. Equip. & Elect. Components	74	141	200	575	743	868	1,162	1,324	1,404	1,591	1,773
Other Electrical Equipment	743*	763*	783*	941*	1,056*	1,101*	1,167*	1,208*	1,079*	1,048*	1,093*
Aerospace	29	999	1,285	2,138	2,574	2,609	3,090	3,514	3,829	4,042	4,712
Autos & Other Transp. Equipment	495	531	561	688	707	856	866	884	936	999	1,090
Fabricated Metal Products	52	55	65	116	135	162	138	145	136	146	153
Professional & Scientific Instrument	178	195	176	200	249	294	309	329	297	309	284
Scientific & Mechanical Measures	86	94	85	97	139	156	159	160	119	101	70
Optical, Surgical & Photo	92	101	91	103	110	138	150	169	178	208	214
Stone, Clay & Glass	40	45	46	60	69	75	81	88	88	96	100
Lumber & Furniture	10	10	10	10	14	12	12	10	10	10	11
Chemicals	374	407	445	641	705	792	891	980	1,101	1,175	1,239
Industrial Chemicals	269	289	315	460	503	553	600	666	706	738	809
Drugs & Medicines	40	50	60	94	104	128	154	162	180	195	216
Other Chemicals	65	68	70	87	98	111	137	152	215	242	214
Paper	29	33	32	36	35	42	49	56	59	65	69
Rubber	54	65	79	105	107	89	115	121	138	141	156
Petroleum	149	167	172	182	211	246	278	296	299	310	317
Food & Beverages	54	61	70	64	74	83	91	104	125	121	130
Textiles & Apparel	10	12	12	12	15	26	30	38	30	28	30
Other Manufacturing	53e	58e	64e	74e	93	105	118	119	105	65	54
ALL MANUFACTURING	3,536e	3,969e	4,529e	6,475e	7,569	8,272	9,479	10,341	10,714	11,230	12,354
ALL NONMANUFACTURING	94e	101e	111e	130e	162	117	139	168	194	234	276
ALL INDUSTRY	3,630	4,070	4,640	6,605	7,731	8,389	9,618	10,509	10,908	11,464	12,630

* - Includes Radio & TV
NA - Not Available
e - Estimated
SOURCE: National Science Foundation.

TABLE VI (Continued)

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES
(Millions of Dollars)

INDUSTRY	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Primary Metals	$195	$213	$232	$242	$251	$257	$275	$272	$277	$307	$358
Iron & Steel	116	128	139	135	135	136	149	144	147	163	181
Nonferrous Metals	79	85	93	107	115	121	126	128	130	145	177
Machinery	1,015	1,065	1,217	1,326	1,483	1,546	1,729	1,860	2,158	2,549	2,985
Electrical Machinery & Communications	2,972	3,200	3,626	3,867	4,083	4,347	4,220	4,389	4,680	4,902	5,011
Radio & TV Receiving Equipment	NA	NA	47	45	55	57	70	64	48	49	51
Commun. Equip. & Elect. Components	1,872	1,989	2,249	2,425	2,520	2,670	2,604	2,739	2,913	3,019	2,913
Other Electrical Equipment	1,100*	1,211*	1,330	1,397	1,508	1,620	1,546	1,586	1,719	1,834	2,047
Aerospace	5,078	5,148	5,526	5,669	5,765	5,878	5,219	4,881	4,950	5,052	5,278
Autos & Other Transp. Equipment	1,182	1,230	1,344	1,354	1,499	1,568	1,591	1,768	2,010	2,477	2,476
Fabricated Metal Products	148	145	154	163	183	182	207	242	253	291	313
Professional & Scientific Instrument	331	403	468	542	663	742	744	746	838	961	1,075
Scientific & Mechanical Measure	74	80	87	104	118	123	131	133	163	186	221
Optical, Surgical & Photo	257	323	381	438	545	619	613	612	675	775	854
Stone, Clay & Glass	109	112	117	136	142	159	167	164	183	199	217
Lumber & Furniture	12	11	12	12	20	18	52	53	64	71	84
Chemicals	1,284	1,356	1,407	1,507	1,589	1,660	1,773	1,832	1,932	2,116	2,450
Industrial Chemicals	865	908	918	966	981	1,007	1,031	1,009	1,031	1,119	1,299
Drugs & Medicines	234	267	308	343	398	444	485	549	607	698	807
Other Chemicals	185	181	181	198	210	209	257	274	294	299	344
Paper	77	94	117	128	144	188	178	187	189	194	237
Rubber	158	162	168	182	223	261	276	289	377	426	469
Petroleum	393	397	371	371	437	467	515	505	468	498	622
Food & Beverages	144	157	164	183	184	199	230	240	259	269	298
Textiles & Apparel	32	38	51	57	58	60	58	59	61	64	69
Other Manufacturing	65	71	77	90	101	121	128	131	146	158	177
ALL MANUFACTURING	13,193	13,801	15,051	15,826	16,826	17,653	17,362	17,816	18,845	20,534	22,119
ALL NONMANUFACTURING	319	384	497	559	603	655	705	704	707	715	768
ALL INDUSTRY	13,512	14,185	15,548	16,385	17,429	18,308	18,067	18,320	19,552	21,249	22,887

NA - Not Available
* - Includes Radio & TV

TABLE VI (Continued)

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES
(Millions of Dollars)

INDUSTRY	1975	1976	1977	1978	1979	1980	1981
Primary Metals	$443	$506	$538	$560	$634	$728	$878
Iron & Steel	215	256	284	314	375	443	487
Nonferrous Metals	228	250	254	246	259	285	391
Machinery	3,196	3,487	3,880	4,283	4,825	5,901	6,818
Electrical Machinery & Communications	5,105	5,636	5,886	6,507	7,824	9,175	10,329
Radic & TV Receiving Equipment	50	52	96	130	245	556	572
Commun. Equip. & Elect. Components	2,934	3,202	3,495	3,901	4,804	5,571	6,331
Other Electrical Equipment	2,121	2,382	2,295	2,476	2,775	3,048	3,426
Aerospace	5,713	6,339	7,033	7,536	8,041	9,198	11,968
Autos & Other Transp. Equipment	2,430	2,872	3,478	4,010	4,668	5,117	4,986
Fabricated Metal Products	324	358	386	384	455	550	624
Professional & Scientific Instrument	1,173	1,331	1,571	1,998	2,505	3,029	3,614
Scientific & Mechanical Measures	266	325	452	670	950	1,352	1,499
Optical, Surgical & Photo	907	1,007	1,119	1,328	1,555	1,677	2,115
Stone, Clay & Glass	233	263	287	324	356	406	467
Lumber & Furniture	88	107	123	126	139	148	161
Chemicals	2,727	3,017	3,202	3,580	4,038	4,636	5,625
Industrial Chemicals	1,391	1,524	1,668	1,798	1,962	2,197	2,802
Drugs & Medicines	981	1,091	1,117	1,308	1,517	1,777	2,231
Other Chemicals	354	401	417	474	559	662	592
Paper	249	313	333	387	445	495	566
Rubber	467	502	491	493	577	656	678
Petroleum	693	767	918	1,060	1,262	1,552	1,958
Food & Beverages	335	355	415	472	528	620	641
Textiles & Apparel	70	82	83	89	101	115	130
Other Manufacturing	205	217	243	266	288	364	461
ALL MANUFACTURING	23,452	26,152	28,867	32,075	36,686	42,690	49,904
ALL NONMANUFACTURING	735	845	958	1,229	1,540	1,815	1,906
ALL INDUSTRY	24,187	26,997	29,825	33,304	38,226	44,505	51,810

TABLE VII

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES AS A PERCENT OF CAPITAL INVESTMENT
(Percent)

INDUSTRY	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Primary Metals	4.53%	8.12%	8.31%	6.12%	4.82%	8.91%	13.10%	10.66%	15.39%	15.55%	13.66%
Iron & Steel	4.47	7.46	6.97	5.34	4.71	8.08	10.37	7.61	11.40	12.76	12.05
Nonferrous Metals	4.65	9.62	12.17	7.95	5.00	10.63	19.43	23.44	27.24	21.76	16.74
Machinery	41.77	51.88	56.17	50.28	52.27	84.89	91.18	78.43	81.17	72.54	77.26
Electrical Machinery	151.30	177.25	189.04	207.67	243.78	339.48	328.03	248.24	236.48	266.57	280.98
Aerospace	552.67	666.00	558.70	577.84	559.57	931.79	1030.00	1033.53	1276.33	1010.50	1079.91
Autos & Other Transportation Equipment	36.67	30.00	36.91	31.85	45.32	73.16	64.15	55.25	63.24	63.23	56.48
Fabricated Metals	11.82	11.96	12.50	18.13	19.57	30.57	22.26	24.17	26.15	24.75	22.17
Instruments	161.82	139.29	110.00	105.26	131.05	196.00	162.63	137.08	129.13	118.85	97.93
Stone, Clay & Glass	10.00	10.23	7.19	6.67	8.85	13.64	11.41	11.28	12.57	13.33	14.29
Chemicals	26.52	36.67	44.50	44.21	40.99	60.00	76.15	61.64	68.81	74.37	72.03
Paper	7.07	7.33	6.27	4.50	4.32	7.37	7.54	7.27	9.52	10.48	9.86
Rubber	22.50	32.50	32.92	31.82	32.42	40.45	41.07	35.59	38.33	37.11	40.00
Petroleum	5.19	5.74	5.62	5.26	5.48	9.04	10.00	10.24	10.07	10.06	10.23
Food & Beverages	5.24	5.98	7.14	5.61	6.07	7.55	7.46	7.70	8.33	8.34	8.67
ALL MANUFACTURING	28.45	33.08	36.23	39.65	43.25	63.73	68.89	63.21	68.99	70.06	71.53
ALL NONMANUFACTURING	.44	.48	.46	.46	.53	.40	.45	.52	.60	.66	.77
ALL INDUSTRY	10.81	12.28	12.68	14.76	16.07	19.89	21.48	21.61	22.81	22.36	23.72

TABLE VII (Continued)

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES AS A PERCENT OF CAPITAL INVESTMENT
(Percent)

INDUSTRY	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Primary Metals	9.75%	9.26%	8.53%	8.04%	8.04%	8.89%	9.79%	11.88%	13.58%	12.04%	8.97%
Iron & Steel	8.06	8.05	8.08	7.11	6.72	7.43	9.14	11.34	13.74	13.04	9.33
Nonferrous Metals	14.11	11.97	9.21	9.64	10.36	11.42	10.68	12.55	13.40	11.15	8.63
Machinery	63.04	47.54	41.82	43.91	51.14	42.59	45.74	59.05	66.81	64.21	57.07
Electrical Machinery	254.02	189.35	144.46	123.55	129.21	132.94	120.92	144.85	165.37	140.06	130.16
Aerospace	1238.54	971.32	472.31	453.52	468.70	455.66	593.07	774.76	727.94	580.69	349.54
Autos & Other Transportation Equipment	44.27	38.32	39.07	42.45	49.64	44.67	42.20	60.76	53.89	51.71	46.28
Fabricated Metals	17.41	16.86	13.51	12.64	13.46	13.58	16.97	20.17	17.69	16.08	16.13
Instruments	114.14	80.60	65.00	75.28	90.82	81.54	85.52	93.25	96.32	83.57	90.34
Stone, Clay & Glass	13.46	13.02	10.35	14.78	15.96	14.20	15.75	17.45	13.66	12.59	13.23
Chemicals	61.14	48.09	42.00	48.93	56.75	55.15	52.46	56.02	57.16	49.91	37.87
Paper	8.46	8.79	8.86	8.59	11.34	11.60	10.23	14.50	12.95	9.75	8.20
Rubber	33.62	27.46	25.85	27.16	23.23	24.39	30.00	36.58	36.60	27.48	29.87
Petroleum	11.20	10.23	8.28	7.67	8.81	8.88	9.98	9.69	9.77	10.64	8.51
Food & Beverages	8.23	8.40	7.77	8.93	8.36	7.21	6.93	7.16	7.90	7.43	7.39
ALL MANUFACTURING	62.14	54.31	47.98	49.07	52.03	48.67	46.94	52.43	53.20	48.46	41.57
ALL NONMANUFACTURING	.79	.85	.98	1.09	1.07	1.04	1.03	.94	.83	.75	.74
ALL INDUSTRY	21.91	20.14	18.91	19.64	19.70	18.40	17.11	16.88	16.26	15.43	14.58

TABLE VII (Continued)

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES AS A PERCENT OF CAPITAL INVESTMENT
(Percent)

INDUSTRY	1975	1976	1977	1978	1979	1980	1981	1982
Primary Metals	8.54%	10.10%	11.52%	12.10%	11.57%	11.38%	13.24%	13.51%
Iron & Steel	7.12	8.42	10.18	12.46	12.14	13.47	16.62	14.69
Nonferrous Metals	10.51	12.69	13.51	11.66	10.84	9.16	10.14	11.99
Machinery	64.44	63.06	58.88	59.40	45.87	50.91	66.13	61.12
Electrical Machinery	162.58	153.99	126.04	114.36	107.47	95.67	100.18	112.29
Aerospace	340.06	375.09	349.90	234.04	152.58	130.84	186.12	232.53
Autos & Other Transportation Equip.	57.31	61.11	59.76	55.54	56.24	56.48	59.78	56.23
Fabricated Metals	16.45	16.05	15.50	13.33	14.92	18.58	21.08	22.01
Instruments	110.66	117.79	116.37	125.66	142.33	132.85	53.78	72.21
Stone, Clay & Glass	14.04	14.06	12.81	10.45	9.04	10.63	14.87	12.62
Chemicals	35.74	37.16	39.34	42.32	37.46	36.79	41.36	67.27
Paper	8.36	10.06	9.25	9.70	8.02	7.28	8.42	10.49
Rubber	40.26	38.32	29.76	23.48	26.59	37.92	39.65	51.93
Petroleum	7.23	7.12	7.23	7.60	7.79	7.50	7.33	8.42
Food & Beverages	8.33	7.40	8.11	7.91	7.98	8.39	8.28	9.72
ALL MANUFACTURING	42.70	43.62	41.70	40.23	37.18	36.86	41.70	47.45
ALL NONMANUFACTURING	.72	.76	.74	.81	.90	1.01	.97	1.10
ALL INDUSTRY	15.34	15.75	15.06	14.40	14.13	15.05	16.37	18.63

TABLE VIII

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES AS A PERCENT OF SALES
(Percent)

INDUSTRY	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Primary Metals	.26%	.34%	.28%	.29%	.35%	.49%	.48%	.57%	.57%	.53%	.53%
Iron & Steel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nonferrous Metals	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Machinery	1.35	1.60	1.88	1.91	2.26	2.95	2.89	2.80	2.60	2.51	2.44
Electrical Machinery	4.45	5.60	5.51	7.77	9.01	10.26	10.34	10.75	9.68	9.27	9.60
Aerospace	6.84	8.87	11.17	16.80	17.31	19.90	20.27	24.12	25.43	24.24	26.38
Autos & Other Transp. Equipment	1.99	2.61	2.09	2.90	2.75	4.31	3.54	3.34	3.44	3.52	3.43
Fabricated Metals	.34	.37	.40	.54	.60	.76	.58	.61	.58	.58	.64
Instruments	4.74	5.45	4.53	4.68	5.40	6.30	6.18	6.70	6.29	6.81	6.92
Stone, Clay & Glass	.56	.62	.53	.67	.81	.76	.71	.79	.79	.82	.81
Chemicals	1.99	2.14	2.08	2.82	3.01	3.50	3.44	3.76	4.12	4.08	3.97
Paper	.35	.38	.32	.34	.32	.38	.40	.44	.44	.45	.46
Rubber	1.08	1.41	1.39	1.87	1.86	1.27	1.43	1.49	1.70	1.57	1.62
Petroleum	1.18	1.28	1.22	1.17	1.29	1.57	1.71	1.76	1.78	1.80	1.76
Food & Beverages	.12	.13	.14	.13	.14	.16	.16	.18	.18	.18	.19
Textiles	.08	.10	.09	.09	.10	.16	.17	.22	.23	.21	.20
ALL MANUFACTURING	1.26	1.49	1.57	2.06	2.31	2.53	2.61	2.79	2.89	2.81	2.94

NA - Not Available

TABLE VIII (Continued)

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES AS A PERCENT OF SALES
(Percent)

INDUSTRY	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Primary Metals	.50%	.48%	.48%	.54%	.52%	.53%	.58%	.53%	.47%	.42%	.37%
Iron & Steel	NA	NA	NA	NA	NA	.51	.59	.56	.51	.45	.36
Nonferrous Metals	NA	NA	NA	NA	NA	.57	.57	.61	.54	.48	.47
Machinery	2.87	2.69	2.59	2.69	2.90	2.76	3.06	3.32	3.28	3.28	3.23
Electrical Machinery	9.89	9.33	9.10	9.16	9.02	9.12	8.94	9.15	8.22	8.05	7.61
Aerospace	30.32	29.37	26.00	22.05	20.90	21.88	21.30	21.77	23.66	23.48	20.25
Autos & Other Transp. Equipment	2.85	2.43	2.62	2.90	2.66	2.67	3.16	2.64	2.73	2.86	2.99
Fabricated Metals	.51	.45	.42	.48	.41	.39	.45	.51	.47	.49	.46
Instruments	4.46	4.70	4.72	4.85	5.38	5.65	5.68	5.50	5.39	5.40	5.13
Stone, Clay & Glass	.83	.79	.79	.93	.89	.93	.98	.87	.85	.83	.82
Chemicals	3.82	3.69	3.52	3.64	3.54	3.50	3.65	3.60	3.37	3.32	2.92
Paper	.45	.51	.57	.61	.65	.77	.72	.73	.61	.59	.57
Rubber	1.54	1.42	1.33	1.37	1.49	1.60	1.71	1.63	1.80	1.75	1.68
Petroleum	2.14	2.08	1.82	1.68	1.88	1.91	2.07	1.87	1.63	1.43	1.06
Food & Beverages	.20	.21	.21	.22	.21	.21	.23	.23	.23	.20	.18
Textiles	.19	.19	.26	.29	.26	.26	.26	.25	.22	.20	.21
ALL MANUFACTURING	2.95	2.81	2.80	2.84	2.79	2.75	2.74	2.63	2.49	2.35	2.17

NA - Not Available

TABLE VIII (Continued)

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES AS A PERCENT OF SALES
(Percent)

INDUSTRY	1975	1976	1977	1978	1979	1980	1981	1982
Primary Metals	.46%	.62%	.58%	.53%	.51%	.60%	.64%	.78%
Iron & Steel	.51	.55	.56	.53	.56	.72	.70	1.08
Nonferrous Metals	.77	.68	.61	.53	.46	.48	.58	.54
Machinery	3.33	3.30	3.17	2.99	2.90	3.27	3.35	4.36
Electrical Machinery	7.95	7.62	6.66	6.47	6.74	7.14	7.49	8.48
Aerospace	19.66	20.66	21.68	20.14	16.61	15.73	18.46	22.07
Autos & Other Transportation Equipment	2.77	2.60	2.58	2.65	3.05	4.00	3.61	3.89
Fabricated Metals	.47	.46	.43	.38	.30	.47	.51	.50
Instruments	5.32	5.32	5.44	5.94	6.64	6.87	7.60	8.29
Stone, Clay & Glass	.86	.86	.81	.78	.78	.88	.95	1.05
Chemicals	3.04	2.90	2.71	2.76	2.73	2.87	3.21	3.81
Paper	.60	.65	.64	.68	.68	.68	.71	.79
Rubber	1.71	1.58	1.24	1.14	1.23	1.39	1.46	1.77
Petroleum	1.00	.93	.94	1.02	.85	.78	.89	1.09
Food & Beverages	.19	.20	.22	.22	.22	.24	.24	.27
Textiles	.21	.22	.20	.21	.22	.24	.25	.27
ALL MANUFACTURING	2.26	2.21	2.13	2.11	2.12	2.31	2.50	2.97

TABLE IX

NEW PRODUCTS AS A PERCENT OF SALES FOUR YEARS AHEAD--HISTORICAL EXPECTATIONS
(Percent)

INDUSTRY	Spring 1957 For 1960	Spring 1960 For 1963	Spring 1961 For 1964	Spring 1962 For 1965	Spring 1963 For 1966	Spring 1964 For 1967	Spring 1965 For 1968	Spring 1966 For 1969	Spring 1967 For 1970
Iron & Steel	5%	10%	7%	5%	8%	9%	10%	7%	8%
Nonferrous Metals	5	7	11	9	9	13	11	9	16
Machinery	19	16	23	23	22	20	18	23	25
Electrical Machinery	18	18	16	22	22	16	23	24	26
Autos, Trucks & Parts	10	11	11	10	14	16	11	22	24
Aerospace	37	27	29	34	36	24	33	40	49
Other Transportation Equipment							19	23	12
Fabricated Metal Products									
Instruments	14	15	13	18	22	26	20	17	18
Chemicals	16	14	20	16	16	18	15	18	20
Paper	9	8	12	10	8	8	8	7	10
Rubber	5	7	7	6	8	19	14	4	7
Petroleum	2	4	5	6	4	3	4	5	7
Stone, Clay & Glass	8	9	13	13	12	14	13	17	20
Food & Beverages	7	8	12	12	7	10	9	11	12
Textiles	12	9	10	13	14	15	15	13	21
*ALL MANUFACTURING	10	12	14	14	13	15	13	15	17

* Includes miscellaneous manufacturing

TABLE IX (Continued)

NEW PRODUCTS AS A PERCENT OF SALES FOUR YEARS AHEAD--HISTORICAL EXPECTATIONS
(Percent)

INDUSTRY	Spring 1968 For 1971	Spring 1969 For 1972	Spring 1970 For 1973	Spring 1971 For 1974	Spring 1972 For 1975	Spring 1973 For 1976	Spring 1974 For 1977	Spring 1975 For 1978	Spring 1976 For 1979
Iron & Steel	7%	7%	8%	8%	10%	7%	6%	6%	10%
Nonferrous Metals	14	11	8	10	10	8	9	10	7
Machinery	22	21	20	24	24	26	27	27	25
Electrical Machinery	24	20	20	19	17	20	21	20	15
Autos, Trucks & Parts	24	17	30	31	40	40	73	40	32
Aerospace	49	51	52	31	41	18	27	18	13
Other Transporation Equipment	20	10	37	15	4	9	9	15	7
Fabricated Metal Products	24	20	19	15	18	15	17	10	16
Instruments			35	23	24	22	24	19	21
Chemicals	16	16	17	13	16	14	15	9	24
Paper & Pulp	8	12	9	19	14	14	10	7	9
Rubber	9	8	6	12	12	17	14	6	9
Petroleum	8	6	6	7	6	5	3	3	3
Stone, Clay & Glass	16	15	32	14	11	13	13	11	13
Food & Beverages	8	8	13	10	10	9	6	8	12
Textiles	20	18	14	18	15	9	17	24	15
Miscellaneous Manufacturing	12	11	15	11	19	5	13	9	12
*ALL MANUFACTURING	17	16	19	16	18	15	18	14	15

*Includes miscellaneous manufacturing

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TABLE IX (Continued)

NEW PRODUCTS AS A PERCENT OF SALES FOUR YEARS AHEAD--HISTORICAL EXPECTATIONS
(Percent)

INDUSTRY	Spring 1977 For 1980	Spring 1978 For 1981	Spring 1979 For 1982	Spring 1980 For 1983	Spring 1981 For 1984	Spring 1982 For 1985	Spring 1983 For 1986
Iron & Steel	5%	9%	8%	7%	9%	10	21
Nonferrous Metals	6	10	7	4	5	4	9
Machinery	25	26	20	15	12	25	26
Electrical Machinery	16	18	21	17	17	21	22
Autos, Trucks & Parts	18	11	26	67	15	31	25
Aerospace	17	16	27	11	12	40	34
Other Transportation Equipment	17	9	9	NA	NA	NA	NA
Fabricated Metal Products	9	22	12	17	4	17	19
Instruments	21	24	15	31	25	56	43
Chemicals	19	12	12	10	9	11	40
Paper & Pulp	8	10	6	6	6	23	7
Rubber	8	14	16	8	11	16	10
Petroleum	3	3	2	5	3	4	6
Stone, Clay & Glass	11	10	12	10	8	6	4
Food & Beverages	11	17	10	13	17	7	15
Textiles	15	15	14	17	2	11	34
*ALL MANUFACTURING	13	14	13	15	11	15	32

*Includes miscellaneous manufacturing

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TABLE X - PERCENT OF R&D GOING FOR NEW PRODUCTS, NEW PROCESSES, AND IMPROVEMENT OF EXISTING PRODUCTS - HISTORICAL

	1974			1975			1976		
	New Products	New Processes	Improving Products	New Products	New Processes	Improving Products	New Products	New Processes	Improving Products
Iron & Steel	36	18	76	15	11	74	19	30	51
Nonferrous Metals	21	49	30	24	48	28	17	52	31
Electrical Machinery	51	11	38	19	10	71	12	6	82
Machinery	40	7	53	43	11	46	25	13	62
Aerospace	24	9	67	47	8	45	41	7	52
Autos, Trucks & Parts	32	20	48	21	29	50	20	35	45
Stone, Clay & Glass	21	23	56	41	26	33	20	29	51
Fabricated Metals	24	22	54	24	26	50	19	11	70
Instruments	44	23	33	47	16	37	54	13	33
Chemicals	31	18	51	37	12	51	37	8	55
Paper	30	29	41	10	41	49	25	26	49
Rubber	25	24	51	24	15	61	20	15	65
Petroleum	23	39	38	17	45	38	18	40	42
Textiles	21	27	52	21	22	57	25	17	58
Food & Beverages	41	25	34	40	22	38	50	20	30
ALL MANUFACTURING*	36	14	50	33	14	53	29	13	58

*Includes Industries Not Shown Separately

TABLE X - PERCENT OF R&D GOING FOR NEW PRODUCTS, NEW PROCESSES, AND IMPROVEMENT OF EXISTING PRODUCTS - HISTORICAL
(Cont'd.)

	1977			1978			1979		
	New Products	New Processes	Improving Products	New Products	New Processes	Improving Products	New Products	New Processes	Improving Products
Iron & Steel	24	25	51	22	29	49	20	9	71
Nonferrous Metals	17	50	33	18	54	28	5	27	68
Electrical Machinery	9	6	85	30	34	36	32	30	38
Machinery	33	14	53	42	11	47	40	8	52
Aerospace	30	11	59	39	24	37	43	22	35
Autos, Trucks & Parts	20	38	42	27	33	40	60	19	21
Stone, Clay & Glass	29	23	48	24	34	42	37	33	30
Fabricated Metals	40	28	32	38	19	43	33	17	50
Instruments	62	13	25	55	15	30	80	11	9
Chemicals	30	20	50	26	16	58	31	23	45
Paper	23	30	47	32	19	49	25	24	51
Rubber	27	18	55	40	19	41	29	22	49
Petroleum	25	25	50	25	25	50	23	47	30
Textiles	19	26	55	18	30	52	12	39	49
Food & Beverages	38	33	29	34	20	46	20	20	60
ALL MANUFACTURING*	26	17	57	34	24	42	40	22	37

*Includes Industries Not Shown Separately

TABLE X - PERCENT OF R&D GOING FOR NEW PRODUCTS, NEW PROCESSES, AND IMPROVEMENT OF EXISTING PRODUCTS - HISTORICAL
(Cont'd.)

	1980			1981			1982		
	New Products	New Processes	Improving Products	New Products	New Processes	Improving Products	New Products	New Processes	Improving Products
Iron & Steel	40	16	44	56	10	34	43	13	44
Nonferrous Metals	5	73	22	20	46	34	22	26	52
Electrical Machinery	35	29	36	41	12	47	37	20	43
Machinery	24	5	71	47	24	29	35	27	38
Aerospace	51	12	37	41	9	44	47	16	37
Autos, Trucks & Parts	27	11	62	61	19	20	23	12	47
Stone, Clay & Glass	32	30	38	17	23	60	29	23	47
Fabricated Metals	48	19	33	50	20	30	32	22	46
Instruments	73	8	19	40	51	9	76	11	14
Chemicals	31	19	50	25	31	44	27	21	52
Paper	61	8	31	27	29	44	21	55	23
Rubber	28	29	43	32	17	51	29	21	50
Petroleum	13	55	32	20	71	9	23	57	20
Textiles	6	89	5	5	49	46	37	25	39
Food & Beverages	29	28	43	16	22	62	19	21	60
ALL MANUFACTURING	37	19	44	40	23	37	38	21	41